MHz band, which is the only other allocation for DSRC, is plagued with proprietary systems for individual toll or regulatory entities that cause incompatibility and/or interference that hampers interstate commerce.[43] Johns Hopkins University, Applied Physics Laboratory (Johns Hopkins) maintains that equipment costs are multiplied because a motorist, such as a commercial vehicle operator, must purchase more than one transponder, *i.e.*, on-board unit,[44] per state or region. Some states have more than one toll system, which often have incompatible ETC systems.[45] These multiple transponders degrade performance and reliability and increase the potential for interference of ETCs.[46] For the individual states, new start-up costs are higher and "many potential new services and their value-added benefits to the nation are not realized because of this entry cost."[47] According to the International Bridge, Tunnel and Turnpike Association (IBTTA), several regions or states have attempted to address interoperability issues among their ETC systems through a patchwork of multi-mode readers and transponders, resulting in complex, proprietary systems that limit ETC system performance.[48] DOT states that "[o]nly such standards can realistically spur the advancement and deployment of DSRC technology in ways that will make a difference to the safety and efficiency of the nation's surface transportation system."[49]

13. *Discussion.* As a general rule, the Commission does not select a single standard for equipment, leaving the selection of technology to its licensees.[50] Nonetheless, as most commenters advise, we are persuaded that adopting a standard for the DSRCS is appropriate for four reasons: interoperability, robust safety/public safety communications, to promote deployment of DSRC while reducing costs, and consistency with Congressional intent.

14. *Interoperability.* The primary goals of DSRC-based ITS applications are to increase the safety and efficiency of the nation's surface transportation system. To accomplish these goals, DOT envisions a 5.9 GHz DSRCS unit (On-Board Unit or OBU) in every vehicle, working in conjunction with a substantial infrastructure of DSRCS roadside units (RSUs). Information would be transmitted between OBUs and RSUs and between OBUs. Without an interoperability standard that enables units to communicate with one another regardless of location, equipment used, or the licensee, the overall

[43] *Id.* DSRC licensees in the LMS have continued to express concern that they will be required to migrate from the 902-928 MHz band to the 5.9 GHz band before they are ready to do so. E-ZPass indicates that while it is anticipated that existing Electronic Toll Collection operations in the 902-928 MHz band will migrate over time to the 5.9 GHz band, an extended implementation process requiring dual transitional operations in both the 902-928 MHz band and 5.9 GHz band will be necessary. E-ZPass Comments at iii. Johns Hopkins notes that FHWA requires Commercial Vehicle Operations projects receiving federal funds to comply with a 902-928 MHz standard, commonly referred to as the Sandwich Specification. Johns Hopkins Comments at 5. Commenters also note the significant amount of public investment in DSRC operations in the 902-928 MHz band. For instance, IBTTA reports that over $1.5 billion has been invested in Electronic Toll Collections (ETCs) in the 902-928 MHz band. IBTTA Comments at 2. As we stated in the *NPRM* and we reiterate here, we do not have plans, at this time, to require DSRC-based ITS systems operating in the 902-928 MHz band to relocate to the 5.9 GHz band.

[44] Johns Hopkins Comments at 4.

[45] July *Ex Parte* Comments at 30.

[46] *Id.*

[47] *Id.*

[48] IBTTA Comments at 3.

[49] DOT Comments at 4-5.

[50] *See, e.g., NPRM*, 17 FCC Rcd at 23157 ¶ 32.

effectiveness of the national DSRC operations would be drastically reduced.[51] As the Commission acknowledged in the *NPRM*,[52] and as we reaffirm here, the importance on both the societal and individual level of effective DSRC-based ITS applications, especially the safety applications such as crash avoidance and intersection collision avoidance, cannot be underestimated.[53]

15. *Robust safety/public safety communications.* Timeliness and reliability are essential components in this service[54] because DSRC operations in the 5.9 GHz band will be used for, among other things, crash avoidance applications involving vehicle-to-vehicle communications and intersection collision avoidance applications.[55] As such, we further conclude that it is paramount that such communications be protected from interference given the consequences to the traveling public should any one of the safety applications fail due to unacceptable error rates or delay. In this connection, we also agree with the commenters that non-public safety use of the 5.9 GHz band would be inappropriate if such use would degrade the safety/public safety applications.[56]

16. *Promote deployment of nationwide DSRC-based ITS applications.* We agree with the commenters that adopting a standard will reduce overall implementation costs and accelerate deployment of DSRC-based ITS applications. The record clearly establishes that non-public safety use of this band is essential to promote the early deployment of all DSRC applications. In this connection, we further find that adopting a standard that includes technical rules to prevent degradation of public safety applications serves the public interest by allowing non-public safety use of the band, which promotes DSRC deployment nationwide. If we do not adopt a single standard, DOT[57] and ITS America maintain that equipment developers will adopt a wait-and-see approach on how the market develops or "create proprietary technologies in the hopes of grabbing market share and shutting out other competitors."[58] There is further concern that this scenario would result in a "fragmented market for DSRC products and

[51] We agree that the interoperability problems experienced among ETCs are instructive here because ETC is the most widely-deployed DSRC-based ITS application, to date.

[52] *See NPRM,* 17 FCC Rcd at 23154 ¶ 26.

[53] In 2002, there were 6,315,309 motor vehicle crashes, *see* Fatality Analysis Reporting System (FARS) and the National Automotive Sampling System General Estimates System (NASS GES) at 7 (date) at http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2003/Assess02.pdf in which 42,815 people were killed and 2,926,000 were injured. *See* National Highway Traffic Safety Administration, 2002 Annual Assessment Motor Vehicle Traffic Crash Fatality and Injury Estimates for 2002. Each year, more than 1.8 million crashes occur at intersections. *See* Federal Highway Administration, Stop Red Light Running at http://safety.fhwa.dot.gov/fourth level/pro_res_srlr_facts.htm. In 1998, there were 937,966 road departure crashes. *See* Department of Transportation, IVI 8 Major Problem Areas, http://www.its.dot.gov/ivi/8MPA.html. Over the last five years, on average, about 760 people have been killed by motor vehicles in work zones each year.[53] Federal Highway Administration, Work Zone Facts, http://safety.fhwa.dot.gov/fourth;eve;/pro_res_wzs_facts.htm.

[54] Alliance of Automobile Manufacturers Comments at 7.

[55] DOT has identified four types of collisions that account for nearly 80 percent of highway crashes: (1) intersection collisions; (2) rear-end collisions; (3) road departure collisions; and (4) lane changes and merge collisions. *See* http://www.its.dot.gov/ivi/3DC.html.

[56] ARINC Incorporated Comments at 7 ("if a mandatory standard is not adopted, one or more companies could introduce radio techniques in the band that would be incompatible and could interfere with safety operations").

[57] DOT Comments at 4-5 (ITS program offers the potential to save thousands of lives each year, but "current indications are that this potential is less likely to be reached without a market sizable enough to attract private investment in technological advances and cost reductions necessary to appeal to the traveling public.").

[58] *Id.* at 9.

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services, higher costs for all, and 'stovepipe' deployments that are not interoperable."[59] Many commenters also relate that a market limited to public safety users would be relatively small"[60] whereas a single standard would promote DSRC deployment while providing public safety entities and the public with the benefit of the economies of scale resulting from the larger market.[61]

17. *Consistent with Congressional intent.* Finally, we believe adoption of an interoperability standard is consistent with Congress' intent when it adopted legislation concerning DSRCS.[62] In this connection, we note that the FHWA reported to Congress that adoption of a standard for DSRC operations in the 5.9 GHz band was a "critical standard" for the development of ITS.[63] Accordingly, we further believe that adopting a standard would meet the goals of TEA-21 and be a significant step towards achieving the goals of the national ITS program to increase the safety and efficiency of the nation's surface transportation system.

2. Selection of a Standard for DSRC

18. Based on the record before us, we will require all DSRCS operations in the 5.9 GHz band to comply with the ASTM-DSRC Standard. We note that most commenters urge this approach, and that the record presents no alternative standard or other technical rules that would both achieve interoperability and allow open eligibility. In this connection, we recognize that use of the ASTM-DSRC Standard will require compliance with certain technical parameters, such as power limits and receiver performance specifications, upon which interoperability does not depend. We nonetheless believe, based on the record of this proceeding, that requiring compliance with all aspects of the Standard is critical to the success of the DSRC service, which is an integral component of the ITS program. Specifically, even those components of the standard that do not directly serve interoperability goals serve an interference management purpose which will facilitate effective and robust public safety communications. Similarly, requiring use of equipment that meets the ASTM-DSRC Standard will help ensure that an adequate market develops for equipment that will meet the needs of the public safety DSRCS licensees. In short, the record has convinced us that if this service is to succeed in facilitating rapid deployment of ITS technologies to improve the safety of our nation's roadways, all DSRCS licensees should be required to use only ASTM-DSRC compliant equipment.

19. As detailed in the *NPRM*, the ASTM-DSRC Standard, is based on the IEEE 802.11 and 802.11a standards and was developed by the ASTM under a cooperative agreement with the FHWA.[64] ASTM operates as a consensus-based organization in accordance with the operating principles of the American National Standards Institute (ANSI); ASTM is a participating member of ANSI.[65] ASTM,

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[59] *Id.*

[60] *See e.g.*, DOT Comments at 4. *See also* ITS America Comments at 8.

[61] *Id.*, E-ZPass Comments at 4; IBTTA Comments at 2 (market will be larger if both public safety and non-public safety DSRC-based ITS applications use the same standard, original equipment manufacturers would introduce OBUs as original manufactured hardware). *See* paras. 6, 8.

[62] The DSRC program was created by Congress. The congressional legislation creating this program required DOT to develop and implement standards and protocols to the extent practicable to promote compatibility between DSRC systems operating across the nation. Later legislation directed DOT to promote interoperability through a National Architecture.

[63] U.S. Department of Transportation, *Intelligent Transportation Systems: Critical Standards* at 19 (June 1999).

[64] *See NPRM*, 17 FCC Rcd at 23155 ¶ 28.

[65] *See* July *Ex Parte* Comments at 13.

through the Standards Writing Group,[66] developed the ASTM-DSRC Standard, which was approved on July 10, 2003 and published in September 2003.[67] The ASTM-DSRC Standard "is a product of a rigorous and concerted effort, for several years, which involved extensive participation of a broad cross section of the international, scientific, manufacturing, and user communities. Consensus was reached amongst these participants who came from diverse interests, technical backgrounds and experiences."[68] In this connection, DOT as well as NTIA urge us to adopt the ASTM-DSRC Standard into our Rules.[69]

20. Given that 802.11a equipment is readily available, adopting the ASTM-DSRC Standard will promote the rapid development and deployment of DSRC equipment.[70] Moreover, as ITS America notes, the ASTM-DSRC Standard "is written to be a technical baseline for equipment and service developers to compete on the basis of performance, quality, and different forms of DSRC applications."[71] In this connection, we also note that adopting the ASTM-DSRC standard does not unduly restrict technical innovation given the long life-cycle of motor vehicles.[72] Rather, this long life cycle makes "backward" compatibility critical as DSRC-based ITS applications continue to develop and evolve in the future. In this connection, Nissan explains that, generally, the lower protocol layers of the standard are implemented in silicon chip sets, while the upper layers are implemented in software. Thus, according to Nissan, our adoption of the lower layers would ensure the long-term stability of the hardware while permitting the upper layers to evolve through software upgrades.[73] Moreover, the Alliance of Automobile Manufacturers advises that the ASTM standards development process appears capable of making certain that revisions to the ASTM-DSRC Standard "will continue to support earlier implementations of the standard, thus ensuring long-term stability in the fundamental technical hardware basis for DSRC."[74]

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[66] See Appendix E for a list of Standards Writing Group participants. *See also* note 18, *supra*.

[67] ASTM-DSRC Standard at 1.

[68] E-ZPass Comments at 7-8; TransCore Corporation Comments at 4-5 (ASTM is an ANSI-accredited Standards Development Organization (SDO), which ensures that the standard was developed and approved in an open and fair process.).

[69] *See* DOT Comments at 6; NTIA Comments at 17 (there "would be a substantial public benefit in facilitating national interoperability of DSRC technology.").

[70] E-ZPass Comments at 8 (because the ASTM-DSRC Standard is based on the widely used IEEE 802.11 and 802.11a, a large manufacturing base of compatible devices already exists); Highway Electronics Comments at 2 (the "[s]ister 802 technologies are becoming the standard for wired Local Area, Medium Area, and Wide Area Network (LAN, MAN, WAN) implementations," thus, the "required use of the technology in the ITS Band will support the seamless extension of the LAN, MAN, and WAN systems into the WLAN mobile environment."); TransCore Corporation Comments at 4 ("adoption of the ASTM-DSRC standard will speed market acceptance, create additional incentives for manufacturers to design and develop mass market – and niche market – equipment, and provide a platform upon which to support future innovative products.").

[71] ITS America Comments at 7; Intersil Corporation Comments at 6 (adoption of Layers 1 and 2 would provide for "coexistence without interference," thus enabling different services to operate in close proximity).

[72] *See, e.g.,* Nissan North America, Inc. Comments at 5 (modern automobiles have a long life cycle in comparison with consumer electronics devices, in many cases extending to ten years or more).

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21. We note that two commenters that support adoption of the ASTM-DSRC Standard would have us codify exceptions for equipment designed for special use or limited applications.[75] We decline to do so by rule, however, given the weight of the record in support of an interoperability standard for all DSRC operations in the 5.9 GHz band. Nonetheless, we also recognize that provisions of the ASTM-DSRC Standard are rigorous and detailed, which could impede the deployment of future technological advances in the DSRCS. As DSRC technology develops, any waiver requests[76] will be reviewed by the Commission, in consultation with DOT as appropriate.

22. ITS America and several other commenters urge us to adopt a rule today that automatically requires new equipment to meet future versions of the ASTM-DSRC Standard[77] and these suggestions are well taken. We recognize that the standard will be revised in the future to reflect technological advances. Nonetheless, we decline to adopt an "automatic update" rule given the rigorous and detailed mandates of the ASTM-DSRC Standard. In this connection, we are concerned that future revisions could impact a widespread incumbent base.[78] Therefore, at this time, we are adopting the existing version of the ASTM-DSRC Standard and will consider future revisions as they arise. As noted in paragraph 20, *supra*, we anticipate that all revisions will be "backward" compatible, *i.e.*, will continue to support earlier implementations of the standard, thus ensuring long-term stability in the fundamental technical hardware basis for DSRC.

3. The ASTM-DSRC Standard

a. DSRC Operations

23. DSRC provides highly reliable real-time data communications with a rapidly moving vehicle.[79] The ASTM-DSRC Standard is an extension of IEEE 802.11[80] and IEEE 802.11a[81] for vehicles traveling at high speeds. The ASTM-DSRC Standard describes a medium access control layer (MAC) and physical layer (PHY) specification for wireless connectivity using DSRC services.[82] The ASTM-DSRC Standard enables wireless communications over short distances between information sources and transactions stations on the roadside and mobile radio units, between mobile units, and between portable units and mobile units.[83] DSRC operations generally occur over line-of-sight distances of less than 1000

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[75] Siemens Transportation System Comments at 7 (private internal systems do not need to be interoperable and, in the case of mass transit systems, interoperability may put them at increased risk of interference from other systems). TransCore Comments at 11 (the Commission should not foreclose the design and development of low-cost simple devices that do not implement all of the capabilities contained in the adopted standard, but provide useful applications without interfering with other DSRC devices).

[76] *See* 47 C.F.R. § 1.925.

[77] ITS America Comments at 11.

[78] *See* PSWN Reply Comments at 6 (Commission should regularly review the ASTM-DSRC Standard to ensure that it remains current).

[79] ASTM-DSRC Standard at 1; Status Report at 5-6.

[80] Wireless LAN Medium Access Control and Physical Layer Specifications. *See* ASTM-DSRC Standard at 1.

[81] Wireless LAN Medium Access Control and Physical Layer Specifications High-Speed Physical Layer in the 5 GHz Band. *See* ASTM-DSRC Standard at 1.

[82] ASTM-DSRC Standard at 1.

[83] *Id.*

meters between roadside units and mostly high speed (up to 120 mph), but occasionally stopped and slow moving vehicles, or between high speed vehicles.[84] DSRC operations will use short-range, low-power data transmissions of limited duration.[85] According to ITS America,[86] the majority of DSRC-based ITS wireless transmissions will occur either between vehicles or between a moving vehicle and a fixed transmitter in a line-of-sight, point-to-point, or point-to-multipoint configuration.[87] In many instances, ITS America states that the vehicle will be traveling at highway speeds and will quickly pass through the "communications zone" of a fixed transmitter.[88]

24. In-vehicle communications units are called On-Board Units (OBUs).[89] An OBU is a DSRC transceiver that is normally mounted in or on a vehicle, but which in some instances may be a portable unit.[90] An OBU can be operational while a vehicle or person is either mobile or stationary.[91] OBUs receive and contend for time to transmit on one or more radio frequency (RF) channels.[92] Except where specifically excluded, OBU operation is permitted wherever vehicle operation or human passage is permitted.[93] Communication units that are fixed along the roadside, over the road on gantries or poles, or off the road in private or public areas are called RSUs.[94] An RSU is a DSRC transceiver that is mounted along a roadside or pedestrian passageway.[95] An RSU may also be mounted on a vehicle or is hand carried, but it may only operate when the vehicle or hand carried unit is stationary.[96] An RSU transmits data to or exchanges data with OBUs in its communications zone.[97] The ASTM-DSRC Standard also establishes band segments as well as other technical and operating parameters, most significantly a "control channel," which is described below.

b. Band Plan

25. *Background*. The Commission sought comment on the band plan proposed by ITS America, which would divide the 5.9 GHz band into the following channels: seven, ten-megahertz channels consisting of one Control Channel (Channel 178) and six Service Channels (Channels 172, 174,

[84] *Id.*

[85] July *Ex Parte* Comments at 48.

[86] *See* Status Report at 4-5.

[87] July *Ex Parte* Comments at 27.

[88] *Id.*

[89] ASTM-DSRC Standard at 1-2.

[90] *Id.*

[91] *Id.*

[92] *Id.* at 1-2.

[93] *Id.* at 2.

[94] *Id.*

[95] *Id.*

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[91] *Id.*

[92] *Id.* at 1-2.

[93] *Id.* at 2.

[94] *Id.*

[95] *Id.*

[96] *Id.*

[97] *Id.*

176, 180, 182, and 184) and one, five megahertz channel, which would be held in reserve.[98] Under the ITS America plan, Channel 172 was designated for vehicle-to-vehicle communications and Channel 184 was for high power public safety and non-public safety DSRC operations. Non-public safety applications were secondary to existing public safety applications on Channel 184. Channels 174 and 176 and Channels 180 and 182 could be combined to produce two twenty-megahertz channels, Channel 175 and 181, respectively. We sought comment on ITS America's proposal, invited alternative proposals, and asked whether we should establish a different channel bandwidth.[99]

26. The ASTM-DSRC band plan is supported by all commenters: no commenter recommends changing the size of the channels. Johns Hopkins explains that the sizes were developed to support DSRC in a mobile, high multi-path environment and that channels smaller than ten megahertz would not meet these performance requirements.[100] Sirit Technologies recommends using the five megahertz reserve channel for safety applications or non-public safety applications that do not fully comply with the standard; for instance, simple one-way or two-way data transmissions, such as vehicle identification.[101]

27. *Discussion*. The channels (or segmentations) are an essential component of the ASTM-DSRC Standard that we are adopting herein.[102] In this connection, we note that the band plan reflects a harmonization with Canada and Mexico, and that it is divided into channels that are adequate to support the fundamental band communications needs.[103] We acknowledge the timing concerns raised by the Alliance of Automobile Manufacturers and QUALCOMM as to adopting the band plan before the upper layers of the standard (Layer 3 and above) are final.[104] We agree that our action today is by no means the only prerequisite of DSRC deployment in the 5.9 GHz band. Nonetheless, DOT, which Congress directed to deploy ITS and ensure interoperability, advises that mandatory standards are required to achieve this goal.[105] Additionally, we note that five megahertz is reserved to accommodate future,

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[98] *NPRM*, 17 FCC Rcd at 23159-60 ¶ 36.

[99] *Id.* at ¶ 38.

[100] Johns Hopkins Comments at 18.

[101] Sirit Technologies Comments at 2-3.

[102] *See e.g.,* ASTM-DSRC Standard at 10; 3M Comments at 3 ("channelization is necessary for interoperability").

[103] *See* Highway Electronics Comments at 1-2.

[104] Alliance of Automobile Manufacturers Comments at 11 ("[u]ntil agreement is achieved on the upper layers of the DSRC standard, it is premature to achieve the level of specificity proposed regarding the band plan."); QUALCOMM Incorporated Reply Comments at 3 (until the full set of system specifications have been developed, *e.g.*, specifications for security protocol, control channel operation, and overall system operation, it is premature to mandate the use of the band plan proposed by ITS America).

[105] DOT Comments at 2. "The promise of a market that is nationwide in scope and inclusive of safety and other purposes would in turn provide the necessary incentive to industry to invest in the development of DSRC technologies. The 5.9 GHz band offers the potential to realize these benefits to the fullest. The first condition to the creation of such a market is the adoption of mandatory technical standards (cite omitted). Only such standards can realistically spur the advancement and deployment of DSRC technology in ways that will make a significant difference to the safety and efficiency of the nation's surface transportation system. [Moreover, DOT worked with ASTM to develop the ASTM-DSRC standard, and DOT urges the Commission to adopt it.]" *Id.* at 6.

unforeseen developments.[106] Accordingly, we decline the Sirit Technologies proposal to allow use of the five megahertz at this time.

28. The ASTM-DSRC Standard was approved and published in September 2003. With the exception of the reserve channel (which is simply not discussed in the standard), ITS America's channel plan is generally consistent with the band plan of the ASTM-DSRC Standard. ITS America proposes, however, use-designations that are not included in the standard for Channels 172 and 184. We are addressing these proposals in this section of the item for convenience. Several commenters, including ITS America, propose a change to Channel 172. As originally proposed, Channel 172 would be dedicated for public safety and non-public safety vehicle-to-vehicle communications. According to the Alliance of Automobile Manufacturers, however, they are studying vehicle safety applications that require not only vehicle-to-vehicle communications, but also vehicle-to-roadside communications.[107] Because these applications need a channel of high availability, low latency, and limited message duration, commenters recommend reserving Channel 172 for applications that require a channel of high availability and low latency.[108] These include applications that involve accident avoidance and mitigation techniques.[109] In November 2003, ITS America clarified that Channel 172 should be designated for "vehicle *safety* and other high priority applications to prevent lower priority transmissions from limiting the availability of the channel or increasing the latency of the communications on the channel."[110] Similarly, ITS America recommends that Channel 184 be designated for long range public safety applications and intersection collision applications.[111]

29. Based on the record before us, we believe it is premature to adopt rules that reserve certain service channels for specific applications. We note that virtually all commenters agree that both public safety and non-public safety users should be eligible for licensing on all channels, subject to priority for safety/public safety. Further, as expressed by commenters, we believe channel assignments are best addressed under the priority levels of the Control Channel protocol. This will give transportation experts additional flexibility in system design and should not have a negative impact on interoperability. Finally, we note that DSRC system design is in its infancy and we expect further development and refinement. Thus, we may need to revisit this issue in the future once we have gained more experience with DSRC operations. For reference, the DSRCS band plan is set forth in the following table.

[106] ASTM-DSRC Standard at 9-10 § 8.8.3.3.

[107] Alliance of Automobile Manufacturers Comments at 13.

[108] ITS America Comments at 21.

[109] ARINC Comments at 4.

[110] *Ex Parte* Comments of the Intelligent Transportation Society of America from Robert B. Kelly, counsel to ITS America, to Federal Communications Commission at 3 (filed Nov. 14, 2003). *See also* Nissan North America, Inc. Comments at 6 (recommends dedicating Channel 172 to ensure that vehicle safety applications can migrate away if the Control Channel reaches its capacity limits).

[111] July *Ex Parte* Comments at Appendix D.

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[111] July *Ex Parte* Comments at Appendix D.

5.850 GHz							5.925 GHz
		CH175			CH181		
5850-5855 reserve 5 MHz	CH172 service 10 MHz	CH174 service 10 MHz	CH176 service 10 MHz	CH178 control 10 MHz	CH180 service 10 MHz	CH182 service 10 MHz	CH184 service 10 MHz

c. Control Channel Priority for Safety/Public Safety Communications

30. *Control Channel protocol.* Channel 178 is the Control Channel,[112] a single (ten megahertz) channel accessible throughout the country[113] that establishes a communications link between an RSU and an OBU or between OBUs.[114] OBUs are required to listen to the Control Channel every few hundred milliseconds to check for public safety messages.[115] The length of messages on the Control Channel can vary, but are generally kept short to permit maximum access to the Control Channel.[116] When tuned to the Control Channel, all RSUs and OBUs, by default will listen for a transmission.[117] If an RSU or an OBU desires to transmit a message, but detects the broadcast of another message on the Control Channel, it must wait before attempting to transmit.[118] An OBU or an RSU initiates a "request to send" (RTS) and the Control Channel will grant time first to high priority, *i.e.*, a public safety communications, then to lower priority non-public safety communications.[119] If an RSU or an OBU leaves the Control Channel to communicate on a service channel, a timer, defined by mandatory data transfer time limits, will be activated to indicate it should return to the Control Channel to listen for additional transmissions and distinguish between priority and non-priority calls.[120] In this connection, the Control Channel implements the priority given to public safety communications through a priority interruption capability.[121] Specifically, the Control Channel operates using a "set of rules to provide a Quality of Service (QoS) that includes access time, access priority, and channel capacity service" to RSUs and OBU ("the Control Channel protocol").[122]

31. *Priority framework.* As a preliminary matter, we observe that given the low power of RSUs and other interference-mitigation provisions of the ASTM-DSRC Standard, interference disputes

[112] ASTM-DSRC Standard at 10, Table 8.

[113] Johns Hopkins Comments at 18.

[114] Highway Electronics Comments, Appendix at 1. The Control Channel is used for roadside-to-vehicle, vehicle-to-roadside, and vehicle-to-vehicle, communications and it must be accessed on a periodic basis by every OBU and RSU operating in the 5.9 GHz band. Johns Hopkins Comments at 10-11.

[115] Johns Hopkins Comments at 10.

[116] *Id.*

[117] *Id.*

[118] *Id.*

[119] *Id.*

[120] ASTM-DSRC Standard at 2. Johns Hopkins Comments at 11.

[121] ASTM-DSRC Standard at 2. *See also* Highway Electronics Comments, Appendix at 1.

[122] *Id.*

among DSRCS operations should be rare. Thus, in the context of the DSRCS, "priority" is largely a matter of how messages are ranked and sent under the Control Channel protocol. That is, a higher priority communication will precede or interrupt a lower or non-priority communication, whenever necessary, in which case the lower or non-priority communication will be sent or resent after the higher priority communication is completed. In reviewing the record of this proceeding, we find that Control Channel protocol is capable of giving access priority to public safety communications, thereby ensuring that non-public safety use of the band does not degrade public safety communications.[123] We note, however, that the upper layers of the ASTM-DSRC Standard, which will establish one or more levels of public safety priority over non-public safety communications, are still under development.[124] Given this circumstance, we are adopting the following priority framework based on the record before us.[125]

32. *Safety of life.* First, DSRCS communications involving the imminent safety of life—whether by traditional public safety entities, *i.e.*, state and local governments, or by nongovernmental entities, *e.g.*, vehicle-to-vehicle collision avoidance—must have access priority over all other DSRCS communications.

33. *Public safety vs. non-public safety.* Next, public safety communications—whether by traditional public safety entities or other entities—have access priority over all DSRCS communications except safety of life communications. Should a dispute arise between public safety and non-public safety users, *i.e.*, a dispute or scenario not contemplated/governed by the Control Channel protocol, communications by the following entities will be presumed to be "public safety" priority communications: state and local governments, possessions, territories, districts, and authorities (including mass transit and toll authorities).[126]

34. *Safety/public safety vs. safety/public safety.* Finally, in the event of disputes involving classifications or rankings of DSRCS-based ITS applications *within* the safety and/or public safety priority levels of the Control Channel protocol, we anticipate that the parties will seek resolution of such disputes by the appropriate Federal, state, or local transportation agency(s), in the first instance, as these issues are most appropriately resolved by the agency(s) with expertise in transportation matters. In this connection and based on the record before us, we clarify that it would be permissible for the Control Channel protocol to prioritize: Channel 172 for safety communications that involve vehicle safety and other high priority applications, and Channel 184 for high power public safety and intersection collision applications.[127]

[123] *See* para. 15, *supra* (non-public safety use of the 5.9 GHz band would be inappropriate if such use would degrade the safety/public safety applications).

[124] ASTM-DSRC Standard at 2 § 4.1.1.2(4).

[125] Hence, we need not license non-public safety applications on a secondary basis, as suggested by the Port Authority of New York and New Jersey. Port Authority Comments at 2. Additionally, we observe that the control channel priority for DSRCS operations does not alter the relationship between the co-primary allocations.

[126] *Accord* Development of Operational, Technical and Spectrum Requirements For Meeting Federal, State and Local Public Safety Agency Communications Requirements Through the Year 2010, WT Docket No. 96-86, *First Report and Order and Third Notice of Proposed Rule Making*, 14 FCC Rcd 152, 180 ¶ 53 (1998) (adopted "bright line" eligibility criteria under which governmental entities are presumed eligible for licensing on public safety spectrum.

[127] Non-public safety vs. non-public safety DSRCS disputes are addressed at para. 61, *infra*.

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d. Power Limits

35. *Power limits.* In the *Allocation Report and Order*, the Commission limited the peak transmit output power over the frequency band of operations to no more than 750 mW (28.8 dBm), and the maximum EIRP to no more than 30 W (44.8 dBm).[128] In its petition, Mark IV Industries argued that the 750 mW (28.8 dBm) maximum output power was overly restrictive and should be replaced with an antenna input power of up to 4 watts (36 dBm).[129] Mark IV Industries also states that maximum output power limit does not account for cable loss in cases where a transmitter and the antenna are separated by a large distance. However, in its comments to the *NPRM*, Mark IV Industries supported the adoption of the ASTM-DSRC Standard, which contains power level specifications for each channel, for both public safety and non-public safety RSUs and OBUs. We also note that the overwhelming majority of commenters supported the Standard. Thus, it appears that Mark IV Industries' concerns are satisfied by the incorporation of the ASTM-DSRC Standard into our Rules. The relevant provisions of the ASTM-DSRC Standard establish an overall maximum allowable EIRP at 44.8 dBm (30 W), and the maximum allowable device output power at 28.8 dBm (750 mW). A device is allowed to transmit more power to overcome cable losses to the antenna as long as the antenna input power does not exceed +28.8 dBm and the EIRP does not exceed +44.8 dBm.[130] Further, specific channels and categories of uses have additional limitations, under the ASTM-DSRC Standard,[131] mainly:

- Public Safety and Private RSU installations operating in DSRC Channels 172, 174, 175 and 176 are used to implement small and medium range operations. RSU installation transmissions in DSRC Channels 172, 174, 176 shall not exceed 28.8 dBm antenna input power and 33 dBm EIRP. RSU installation transmissions in DSRC Channel 175 shall not exceed 10 dBm antenna input power and 23 dBm EIRP.

- Public Safety RSU installation transmissions in DSRC Channel 178 shall not exceed 28.8 dBm antenna input power and 44.8 dBm EIRP. Private RSU installation transmissions in DSRC Channel 178 shall not exceed 28.8 dBm antenna input power and 33 dBm EIRP.

- The DSRC Channels 180, 181, and 182 are used to implement small zone operations. Public Safety and Private RSU installations in these DSRC channels shall not exceed 10 dBm antenna input power and 23 dBm EIRP. These installations shall use an antenna with a minimum 6 dBi gain. Interfering emissions from an RSU installation in these DSRC channels shall not exceed a maximum received power level of -76 dBm at 15 m from the installation being evaluated. The received power level is measured at 1.2 m above the ground with a 0 dBi antenna.

- Public Safety RSU and OBU operations in DSRC Channel 184 shall not exceed 28.8 dBm antenna input power and 40 dBm EIRP. Private RSU operations in DSRC Channel 184 shall not exceed 28.8 dBm antenna input power and 33 dBm EIRP.

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[128] *See* 47 C.F.R. § 90.205(o) (1999) (currently § 90.205(p)). *See also Allocation Report and Order*, 14 FCC Rcd 18221, 18232 ¶ 24.

[129] Mark IV Petition at 2. *See also* Intersil Comments at 13.

[130] ITS America recommends a maximum power limit for portable OBUs of 1.0 mW. *See* July *Ex Parte* at 12. We are adopting this recommendation to limit exposure to radiofrequency radiation. *See* paras. 42-43, *infra*.

[131] *See* ASTM-DSRC Standard at 10-11, § 8.9.1.

- Private OBU operations in DSRC Channels 172, 174, 176, 178, and 184 shall not exceed 28.8 dBm antenna input power and 33 dBm EIRP. Private OBU operations in DSRC Channel 175 shall not exceed 10 dBm antenna input power and 23 dBm EIRP. Private OBU operations in DSRC Channels 180, 181, and 182 shall not exceed 20 dBm antenna input power and 23 dBm EIRP.

- Public Safety OBU operations in DSRC Channels 172, 174, and 176 shall not exceed 28.8 dBm antenna input power and 33 dBm EIRP. Public Safety OBU operations in DSRC Channel 175 shall not exceed 10 dBm antenna input power and 23 dBm EIRP.

- Public Safety OBU operations in Channel 178 shall not exceed 28.8 dBm antenna input power and 44.8 dBm EIRP.

- RSUs and OBUs shall transmit only the power needed to communicate over the distance required by the application being supported.

e. Emission Limits

36. In the *NPRM,* we requested comments on whether the attenuation schedule for the emissions mask in Section 90.210(k)(3) was adequate, or whether a Mark IV Industries' (Mark IV's) proposal to limit emissions according to the formula: 55+ 10 log (P) (P is power in Watts), should be adopted.[132] Siemens Transportation Systems (STS) responded that the out-of-band emissions limits for many services, such as those managed under Parts 22, 24, and 90, only require attenuation according to the formula: 43 + 10 log (P). Furthermore, STS asserts that power densities associated with ITS services would likely be lower than power densities for the services considered in Parts 22, 24, and 90. Consequently, STS recommends that out-of-band emissions for DSRC equipment be attenuated according to the formula: 43 + 10 log (P).[133]

37. We understand STS's rationale in its desire to use a less restrictive mask formula, but are also aware of the uniqueness of the DSRC/ITS evolving network, and the diversity of applications to be carried on this 5.9 GHz band. Specifically, it is projected that the density of microwave links will be much higher in this band than for current microwave bands, because RSU transceivers will be placed in close proximity to one another, anywhere from 100 to 1000 meters apart. Such high density requires a more rigorous mask to accomplish the desired sharing of the spectrum. Furthermore, since the development of this band is at its early stages, there is no sufficient empirical data to support the assumption that the STS proposed formula will guard against possible harmful interference among users in such a high density of electromagnetic links environment. We conclude, therefore, that it is safer and in the public interest, given the current development of the band, to use the emission mask and formulas in the ASTM-DSRC Standard as the technical regulatory framework for the band. We reserve discretion to revisit this issue after empirical data become available to construct a reasonable and appropriate propagation model. Finally, given that the ASTM-DSRC Standard contains emission mask limits, we believe that Mark IV's concerns have been addressed by the adoption of the ASTM-DSRC Standard.[134] Nonetheless, because the limits we adopt today are similar to the out-of-band requirements adopted in the

[132] *NPRM,* 17 FCC Rcd at 23176 ¶ 70 citing, ET Docket No. 98-95, Mark IV Petition at 2.

[133] STS Comments at 8-9.

[134] *See, e.g.,* Highway Electronics Comments at 1-2 (ASTM-DSRC spectral mask requirements are necessary for the interference free adjacent channel operation of multiple RSUs and OBUs).

- Private OBU operations in DSRC Channels 172, 174, 176, 178, and 184 shall not exceed 28.8 dBm antenna input power and 33 dBm EIRP. Private OBU operations in DSRC Channel 175 shall not exceed 10 dBm antenna input power and 23 dBm EIRP. Private OBU operations in DSRC Channels 180, 181, and 182 shall not exceed 20 dBm antenna input power and 23 dBm EIRP.

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- Public Safety OBU operations in Channel 178 shall not exceed 28.8 dBm antenna input power and 44.8 dBm EIRP.

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4.9 GHz proceeding,[135] we observe that the National Public Safety Telecommunications Council (NPSTC) has petitioned for reconsideration of the emissions mask and out-of-band requirements adopted therein.[136] Given this recent experience at 4.9 GHz, we reserve discretion to revisit this issue after empirical data becomes available to construct a reasonable and appropriate propagation model.

4. Other Technical Matters

38. We believe that our adoption of the ASTM-DSRC Standard addresses the bulk of the technical issues concerning DSRC operations. Nonetheless, certain technical matters require additional discussion at this juncture.

a. Antenna Height

39. *Antenna Height.* The ASTM-DSRC Standard contains requirements for antenna input power limits, EIRPs, and an antenna position calibration for OBU antennas. The ASTM standard requests that antenna height deviations from the nominal 0.25 meters above ground be reported in increments of 0.1 meter, for the purpose of making accurate calculations of the vehicle's location. Additionally, ITS America proposed to correct the maximum output from RSUs by a factor of 20 log (Ht/6), where Ht is the height of the antenna in meters, in those cases where the antenna height above ground falls between 6 and 15 meters, with a maximum authorized EIRP of 33 dBm for antenna heights of 6 meters or more.[137] 3M, however, states that the antenna height correction factor is not required in the DSRC service.[138] Specifically, 3M states that DSRC communications use the minimum radio frequency (RF) power necessary to complete a communication link regardless of the maximum operating power and that the two-ray propagation model is too simplistic to be applicable to the DSRC radio service.[139] Furthermore, 3M asserts that the two-ray propagation model should not be used for DSRC operations because roadway surfaces are usually curved to aide runoff of water, a clear line-of-sight propagation path is not always available when a receiving vehicle is behind another vehicle, and a clear propagation path for the reflected ray is not always available because of intervening vehicles that are present in an urban environment.[140]

40. The record before us, as well as our experience with land mobile operations generally,[141] persuades us that an antenna height correction factor for DSRC is appropriate to minimize the potential for interference. Although 3M raises concerns focused largely on the specific correction factors recommended by ITS America, the record before us does not include sufficient technical information to support adoption of any other correction factor. Specifically, we find no compelling arguments supported by actual data in the urban and rural environments, or on a proven propagation prediction model, that

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[135] The out-of-band spectral power density limit for operations in the 4.9 GHz band contained in 47 C.F.R. § 90.210(l)(6) is -53 dBm/MHz. *See* In the Matter of The 4.9 GHz Band Transferred from Federal Government Use, *Memorandum Opinion and Third Report and Order*, WT Docket No. 00-32, 18 FCC Rcd 9152 (2002).

[136] *See* Petition for Reconsideration of the National Public Safety Telecommunications Council (NPSTC), WT Docket 00-32, filed July 30, 2003. *See also* Siemens Transportation System Comments at 8-9, indicating that the 55 = 10 LogP is too stringent for DSRCS.

[137] July *Ex Parte* Comments, Appendix C at 9.

[138] 3M Comments at 4.

[139] *Id.*

[140] *Id.* at 5.

[141] *See generally* 47 C.F.R. § 90.205.

would support adoption of another correction factor. Additionally, the ASTM standard does not specify an antenna height correction factor, but specifies maximum power and EIRP levels. We understand that the possibility of direct adjacent harmful interference, and interference in the form of unwanted harmonics, becomes a greater threat as the EIRP and antenna height of the RSU increases, and find ITS America's recommendation complementary to the standard's intention of protecting adjacent users from harmful interference. Nonetheless, we reserve discretion to revisit the adequacy of these parameters if a propagation model more appropriate for DSRC operations in urban and rural areas is developed.[142]

b. Duty Cycle Limit for Control Channel (Channel 178)

41. At the time of the *NPRM,* ITS America indicated that the duty cycle for the Control Channel should be 200 μsec at intervals of less than 100 msec.[143] In discussing ITS America's proposal, ARINC notes that ASTM is in the process of developing a standard that will describe the mechanisms and required limits of the Control Channel operation.[144] On November 7, 2003, however, ITS America proposed a duty cycle limit for the control channel.[145] Specifically, ITS America proposed no limit for public safety applications and a maximum data transmission duration of 750 μsec and 580 μsec for non-public safety RSUs and OBUs, respectively with a minimum interval between data transmissions of 20 msec and 100 msec, respectively. These limits are not contained in the ASTM-DSRC Standard and we did not receive any comment on this latest proposal. We therefore conclude that the record is insufficient to support adopting such limitations. We note that the Commission's rules require licensees to restrict all transmissions to the minimum practical transmission time and that communications involving the imminent safety of life or property are to be accorded priority to all licensees.[146] As noted earlier, the Control Channel Standard is still under development.[147]

c. RF Exposure

42. OBUs may operate as either a mobile or a portable transmitter with respect to Sections 2.1091 and 2.1093 of the Commission's Rules to comply with RF exposure requirements.[148] In mobile configurations, OBU antennas are normally mounted on vehicles where the antennas can be located with sufficient distance from passengers for meeting RF exposure requirements. A separation distance of 50 cm between the antenna and persons is necessary at the maximum output of 30 W EIRP to ensure compliance. This distance should be easily achieved in most vehicle configurations. By

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[142] On November 14, 2003, ITS America reported that the Standards Writing Group voted to delete the following sentence from the antenna height correction factor proposed by ITS America in its July *Ex Parte* Comments at 9: "The maximum authorized effective isotropic radiated power ('EIRP') is 33 dBm for any Roadside Unit installation where the antenna height is six meters or greater above the roadway bed surface." ITS America stated that the additional restriction contained in this sentence will result in inadvertent drop-off in channels with higher EIRP limits and is unnecessary n light of other protections to guard against potential harmful interference. *See* Letter from Robert B. Kelly, Esq., counsel to ITS America, to Marlene H. Dortch, Federal Communications Commission at 2 (Nov. 14, 2003).

[143] July *Ex Parte* Comments at 60.

[144] ARINC Comments at 10.

[145] *See* Letter from Mark D. Johnson, Esq., counsel to ITS America, to Marlene H. Dortch, Secretary, Federal Communications Commission, Attachment (Nov. 7, 2003).

[146] *See* 47 C.F.R. § 90.403(c) and (d). See also discussion of control channel protocol at paras. 0-31, *supra.*

[147] *See* para. 31, *supra.*

[148] 47 C.F.R. §§ 2.1091, 2.1093.

would support adoption of another correction factor. Additionally, the ASTM standard does not specify an antenna height correction factor, but specifies maximum power and EIRP levels. We understand that the possibility of direct adjacent harmful interference, and interference in the form of unwanted harmonics, becomes a greater threat as the EIRP and antenna height of the RSU increases, and find ITS America's recommendation complementary to the standard's intention of protecting adjacent users from harmful interference. Nonetheless, we reserve discretion to revisit the adequacy of these parameters if a propagation model more appropriate for DSRC operations in urban and rural areas is developed.[142]

b. Duty Cycle Limit for Control Channel (Channel 178)

41. At the time of the *NPRM*, ITS America indicated that the duty cycle for the Control Channel should be 200 μsec at intervals of less than 100 msec.[143] In discussing ITS America's proposal, ARINC notes that ASTM is in the process of developing a standard that will describe the mechanisms and required limits of the Control Channel operation.[144] On November 7, 2003, however, ITS America proposed a duty cycle limit for the control channel.[145] Specifically, ITS America proposed no limit for public safety applications and a maximum data transmission duration of 750 μsec and 580 μsec for non-public safety RSUs and OBUs, respectively with a minimum interval between data transmissions of 20 msec and 100 msec, respectively. These limits are not contained in the ASTM-DSRC Standard and we did not receive any comment on this latest proposal. We therefore conclude that the record is insufficient to support adopting such limitations. We note that the Commission's rules require licensees to restrict all transmissions to the minimum practical transmission time and that communications involving the imminent safety of life or property are to be accorded priority to all licensees.[146] As noted earlier, the Control Channel Standard is still under development.[147]

c. RF Exposure

42. OBUs may operate as either a mobile or a portable transmitter with respect to Sections 2.1091 and 2.1093 of the Commission's Rules to comply with RF exposure requirements.[148] In mobile configurations, OBU antennas are normally mounted on vehicles where the antennas can be located with sufficient distance from passengers for meeting RF exposure requirements. A separation distance of 50 cm between the antenna and persons is necessary at the maximum output of 30 W EIRP to ensure compliance. This distance should be easily achieved in most vehicle configurations. By

[142] On November 14, 2003, ITS America reported that the Standards Writing Group voted to delete the following sentence from the antenna height correction factor proposed by ITS America in its July *Ex Parte* Comments at 9: "The maximum authorized effective isotropic radiated power ('EIRP') is 33 dBm for any Roadside Unit installation where the antenna height is six meters or greater above the roadway bed surface." ITS America stated that the additional restriction contained in this sentence will result in inadvertent drop-off in channels with higher EIRP limits and is unnecessary n light of other protections to guard against potential harmful interference. *See* Letter from Robert B. Kelly, Esq., counsel to ITS America, to Marlene H. Dortch, Federal Communications Commission at 2 (Nov. 14, 2003).

[143] July *Ex Parte* Comments at 60.

[144] ARINC Comments at 10.

[145] *See* Letter from Mark D. Johnson, Esq., counsel to ITS America, to Marlene H. Dortch, Secretary, Federal Communications Commission, Attachment (Nov. 7, 2003).

[146] *See* 47 C.F.R. § 90.403(c) and (d). See also discussion of control channel protocol at paras. 0-31, *supra*.

[147] *See* para. 31, *supra*.

[148] 47 C.F.R. §§ 2.1091, 2.1093.

implementing specific antenna installation requirements to ensure compliance, routine MPE evaluation (Section 2.1091) would be unnecessary. In portable configurations, *i.e.*, when the transmitting device is designed to be used within 20 cm of the body of the user, ITS America recommends a maximum output power of 1.0 mW.[149] We note that the specific absorption rate (SAR) limit for portable transmitters is 1.6 W/kg (Section 2.1093) and that it would take 1.6 mW or more to exceed the SAR limit. Therefore, we find that ITS America's proposal is reasonable approach to limit exposure to radiofrequency radiation. In this connection, we consider that under ITS America's approach, certification of portable OBUs will not require SAR evaluations to demonstrate compliance with our RF exposure rules.

43. RSUs are mostly intended to be fixed-mounted on road sides and structures at street intersections but may be mounted in a vehicle or hand carried and operated while stationary. Given that RSUs may only operate when stationary, a minimum separation distance of 50 cm or more can be easily maintained with specific antenna installation procedures to ensure compliance at the maximum output of 30 W EIRP. However, when a stationary RSU is operated in a vehicle mounted or hand carried configuration at higher output power or using high gain antennas, the RSU operator must maintain a minimum separation distance from the antenna to ensure RF exposure compliance. Since RSUs are intended to be used by persons employed in public safety or industrial/business occupations and should not be available to the general public, occupational/controlled exposure limits and occupational RF exposure training (*see* Sections 2.1091 and 2.1093) are applicable. We emphasize that users of hand carried RSUs will need to be able to control their exposure condition and duration to qualify for occupational/controlled limits. This is typically accomplished through RF exposure training instructions.

5. Equipment Certification

44. The Commission sought comment on whether we should require DSRC devices to be certified under our Rules to ensure that they meet our electromagnetic compatibility (EMC) and emission requirements in Part 2. We agree with the majority of commenters, including DOT, NTIA, and ITS America, that we should require that DSRC equipment operating in the 5.9 GHz band be certified according to the procedures in Parts 2, 90, and 95 of our Rules, because these devices will be widely deployed and non-compliance with our requirements could cause serious interference problems.[150] Consequently, we require all transponders, transmitters, and transceivers, whether associated with RSUs or OBUs used in the DSRCS to be certified in accordance with subpart M of Part 90 and subpart L of Part 95, and subpart J of Part 2 of our Rules. In the *NPRM*, we also sought comment on whether the definition of interoperability in the context of DSRC, should include equipment compatibility, so that OBUs and RSUs from different vendors would be interchangeable. Thus, an OBU or RSU manufactured by vendor X would be able to communicate and exchange information with an OBU or RSU manufactured by vendor Y. The Commission also sought comment on whether to adopt equipment performance specifications, such as receiver standards, to reduce the likelihood of interference between devices. Given our adoption of the ASTM-DSRC Standard, however, we now conclude that the definition of "interoperability"[151] and whether to adopt separate equipment performance specifications are largely irrelevant to the DSRCS. In this connection, test procedures to demonstrate compliance with the ASTM-DSRC Standard shall be left to the industry to develop. Compliance with the standard will also be left to industry to determine how to best achieve. To ensure compliance, applicants will be required to

[149] *See* July *Ex Parte* at 12.

[150] DOT Comments at 6; NTIA Comments at 17; ITS America Comments at 20.

[151] *See* 47 C.F.R. § 90.7.

supply a statement that the equipment was tested and complies with the ASTM-DSRC Standard, as a prerequisite for certification.[152]

B. Definitional Issues

1. Intelligent Transportation Radio Service

45. The Intelligent Transportation Radio Service was established by the Commission "for the purpose of integrating radio-based technologies into the *nation's transportation infrastructure*"[153] and is comprised of the Location and Monitoring Service, grandfathered automatic vehicle monitoring systems, and DSRC.[154] In the *NPRM,* we invited comment on whether to amend Section 90.350 of our Rules[155] to limit the use of the Intelligent Transportation radio service to the integration of radio-based technologies to the "nation's surface transportation infrastructure" rather than to the "nation's transportation infrastructure."[156] We received only one comment on this issue; the Public Safety Wireless Network (PSWN) favored making this change as more consistent with the language of ISTEA and TEA-21.[157] Upon further consideration, we conclude that retaining the current definition of the Intelligent Transportation Radio Service best serves the public interest by promoting flexible use of the band. We further conclude that that the current definition is not contrary to ISTEA and TEA-21. In reaching this conclusion, we consider that DOT did not comment on this issue. Accordingly, to promote the flexible use of the 5.9 GHz band, we decline to amend Section 90.350 of our Rules.

2. DSRC Service

46. *Background.* Because the number and kinds of DSRC-based ITS applications continue to evolve, we sought comment on whether the definition of DSRC service in Section 90.7 of the Commission's Rules would include all of the DSRC-based ITS applications envisioned for the band. Section 90.7 defines "Dedicated Short Range Communication Services" as

> The use of non-voice radio techniques to transfer data over short distances between roadside and mobile radio units, between mobile units, and between portable and mobile units to perform operations related to the improvement of traffic flow, traffic safety and other intelligent transportation service applications in a variety of public and commercial environments. DSRC systems may also transmit status and instructional messages related to the units involved.[158]

Specifically, we sought comment on whether to delete the term "non-voice", which would permit the conversion of certain types of data transmissions into voice messages using Voice-over-IP, Voice XML, or another packet radio technique that would "store and forward" the message.[159] To promote the flexible

[152] Given that we are adopting the ASTM-DSRC Standard, we clarify that the definition of "interoperability," 47 C.F.R. § 90.7, is largely irrelevant to DSRC.

[153] 47 C.F.R. § 90.350 (emphasis added).

[154] *See* 47 C.F.R. §§ 90.351, 90.363, and 90.371.

[155] 47 C.F.R. § 90.350.

[156] *NPRM,* 17 FCC Rcd at 23181 ¶ 82.

[157] Public Safety Wireless Network (PSWN) Comments at 13.

[158] 47 C.F.R. § 90.7. *See also* 47 C.F.R. § 90.371(a).

[159] *NPRM,* 17 FCC Rcd at 23147 ¶ 16.

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[158] 47 C.F.R. § 90.7. *See also* 47 C.F.R. § 90.371(a).

[159] *NPRM*, 17 FCC Rcd at 23147 ¶ 16.

use of the band, the Commission sought comment on whether to replace the phrase "in a variety of public and commercial environments" with the phrase "in a variety of environments."[160] We noted that these issues are directly related to eligibility.

47. *Discussion*. Although one commenter[161] opposed deleting the term "non-voice" from the definition of DSRC service, we are persuaded by the reasoning of the other commenters who favored such a change, in particular DOT.[162] DOT indicated that it has been conducting research on how to provide motorists with safety-related information, such as work zones or road condition warnings, without unduly distracting the driver.[163] DOT reports that although its research is not complete, a "voice interface seems to be the most appropriate way to present this information."[164] Consequently, we intend to delete the term "non-voice" from the definition of DSRC service.

48. As noted above, we sought comment on whether to replace the phrase "in a variety of public and commercial environments" with "in a variety of environments." According to ITS America, changing "and commercial environments" to "and private environments," should be coupled with deleting the phrase "non-voice" to ensure that the 5.9 GHz band cannot be used for CMRS or CMRS-like service.[165] In addition to ITS America, Mark IV Industries and Intersil recommended that we expressly exclude the provision of CMRS service or CMRS-type service from the band instead of adopting ambiguous language that could be misinterpreted later.[166] Two commenters, the Alliance of Automobile Manufacturers and TransCore, favored the alternative phrasing.[167]

49. Although the majority of commenters supported ITS America's approach, we shall replace the phrase "and commercial environments" with "in a variety of environments" to preserve flexible use of the 5.9 GHz band. In this connection, we find that the record does not provide a technical basis for excluding CMRS as a definitional matter. Thus, provided that a CMRS operation meets all DSRC service rules, such operation is consistent with our allocation.[168] In sum, on review of the record in this proceeding, we believe that we should amend the definition of DSRC Service as follows:

> The use of radio techniques to transfer information over short distances between roadside and mobile radio units, between mobile units, and between portable and mobile units to perform operations related to the improvement of traffic flow, traffic safety and other intelligent transportation service applications in a variety of environments. DSRC systems may also transmit status and instructional messages related to the units involved.

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[160] *Id.*

[161] 3M Comments at 2.

[162] *See* E-ZPass Comments at 5; ARINC Comments at 2; New York Thruway Comments at 3; Alliance of Automobile Manufacturers Comments at 7; Telecommunications Officials Comments at 2; UC Davis Comments at 1; MTA Bridges & Tunnels Comments at 2; NENA Comments at 2; AASHTO Comments at 4.

[163] DOT Comments at 7.

[164] *Id.*

[165] ITS America Comments at 20-21.

[166] Mark IV Industries Reply Comments at 4; Intersil Corporation Comments 4.

[167] Alliance of Automobile Manufacturers Comments at 7-8. TransCore, LP Comments at 6.

[168] *Allocation Report and Order*, 14 FCC Rcd 18221. We note that any CMRS operations would be subject to E-911 and other CMRS requirements.

C. Eligibility

1. Roadside Units (RSUs)

50. In the NPRM, we tentatively concluded that the 5.9 GHz band should be used primarily for public safety purposes.[169] We also sought comment on how to define public safety; whether public safety and non-public safety licensees should share the band as recommended by ITS America; and how to define non-public safety use, if such uses are allowed.

51. *Discussion.* We continue to believe that public safety communications must have priority over non-public safety communications and we provide for such priority, *supra*.[170] However, the record in this proceeding indicates that public safety DSRC-based ITS applications will benefit from open eligibility through the economies of scale achieved through the development of a larger market consisting of public safety and non-public safety entities. We believe that open eligibility is appropriate in this service, with different technical rules where necessary. This decision is also consistent with Section 257 of the Act, in which Congress articulated a "national policy" in favor of "vigorous economic competition" and the elimination of barriers to market entry by a new generation of telecommunications providers.[171] Accordingly, the only restriction on eligibility will be that required by Section 310(a) of the Communications Act, *i.e.*, foreign governments or representatives of foreign governments.[172]

2. On Board Units (OBUs)

52. DOT envisions that OBUs will be installed in every new vehicle sold or manufactured in the United States,[173] and most of these OBUs will not be associated with any particular RSUs. Taken with our "open eligibility" decision for RSU licensing, we find "open eligibility" to be appropriate for OBUs as well. Accordingly, all motorists will be eligible to operate OBUs unless barred by statute.[174]

D. Licensing Plan

1. DSRC-to –DSRC Issues

a. RSUs

53. In the *NPRM,* we requested comment on whether to license RSUs by site or by geographic area. We also specifically asked commenters to propose other methods of licensing RSUs, such as licensing by rule. The majority of commenters, including ITS America and NTIA favor site-based licensing,[175] although DOT indicates only that it favors a licensing plan that ensures national

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[169] *NPRM*, 17 FCC Rcd at 23149 ¶ 18.

[170] *See* paras 23-38, *supra*.

[171] *See* 47 U.S.C. § 257.

[172] *See* 47 U.S.C. § 310(a). For the licensing requirements for RSUs, see paras. 57-59, *infra*.

[173] July *Ex Parte* Comments at 45 (equipping all new vehicles with OBUs is a primary goal of DOT). *See also Ex Parte* Comments of the United States Department of Transportation, from Paul Samuel Smith, Esq., DOT, at 7 (filed Nov. 5, 2003).

[174] *See, e.g.*, note 172, *supra* and accompanying text. For the licensing requirements for OBUs, see paras. 62-67, *infra*.

[175] ITS America Comments at 12; NTIA Comments at 6-7.

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[175] ITS America Comments at 12; NTIA Comments at 6-7.

interoperability and uniform technical standards.[176] The commenters who favor site-based licensing argue that geographic area licensing promotes exclusivity, whereas the ASTM-DSRC Standard was developed to promote shared use.[177] Specifically, the ASTM-DSRC Standard was developed based on licensees operating within localized "communications zones" with the RSUs transmitting at ranges less than 1000 meters;[178] geographic area licensing, in contrast, is most appropriate, according to commenters, where a service requires high-power 360 degree coverage.[179]

54. Commenters in favor of site-based licensing argue that the ASTM-DSRC Standard was developed based on a site-specific licensing scheme.[180] These commenters believe that site-based licensing better achieves the goal of interoperability because it enables public safety and non-public safety entities to share frequencies.[181] It is more spectrum efficient because it maximizes the number of entities using the spectrum and allows close-spacing and overlapping communications zones.[182] It will enable more intensive spectrum sharing and frequency reuse.[183] It will spur rapid deployment of DSRC–based ITS applications because it will permit the use of factory installed OBUs for use throughout the country and not limited to one geographic area.[184] Site-based licensing will "facilitate the coordination process that is necessary to avoid interference between DSRC RSUs and high power Government radar systems."[185] To prevent new RSU deployments from causing harmful interference to existing DSRCS systems, ITS America would require RSU applications to be frequency coordinated by a Commission-certified frequency coordinator for the private land mobile radio services.[186] The Commission in turn would license each RSU for specific service channels, based on the coordinator's recommendation, as well as the Control Channel.[187] Site-based licensing could be facilitated by the use of high technology "smart antennas"[188]

55. Although these commenters recognize that site-based licensing is more administratively difficult for the Commission than geographic area licensing, they believe there are many ways to lessen

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176 DOT Comments at 8.

177 *See* ITS America Comments at 11-12.

178 NTIA Comments at 6.

179 ITS America Reply Comments at 11.

180 TransCore Reply Comments at 3

181 ITS America Comments at 13-14.

182 ITS America Reply Comments at 11; Johns Hopkins Comments at 14.

183 TransCore Reply Comments at 3

184 Alliance of Automobile Manufacturers Reply Comments at 3.

185 NTIA Comments at i. *See also* 47 C.F.R. § 90.371(b).

186 *See* 47 C.F.R. § 90.175. *See also* July *Ex Parte* Comments at 65-66.

187 July *Ex Parte* Comments at 65-66.

188 John Hopkins Comments at 14. Johns Hopkins states that the "use of high frequency/short wavelength combined with new higher dielectric microwave materials permits tiny, inexpensive antenna arrays, and patches to be customized to service any communication zone requirement. Coverage initially granted to an RSU to serve a broad area could later be adjusted when new RSUs enter the area." *Id.* (citations omitted).

this burden.[189] Specifically, commenters recommend coordination of RSU location by frequency coordinators and management of the applications through the Commission's ULS.[190] ITS America recommends that we use a ribbon or corridor licensing approach for public safety entities, such as freeway authorities, transit agencies, and others that will need to place multiple RSUs "across a large geographic area that will likely cross several jurisdictional boundaries."[191] Other commenters recommend a "blanket" approach under Section 90.353(i) of our Rules for these types of public safety entities.[192] Not all commenters favored site-based licensing. Others favored geographic-area licensing as less cumbersome.[193] Intersil Corporation recommended a licensing by rule approach through the use of a commercially operated web site and private frequency coordination.[194]

56. Based on our analysis of the record before us and the goals and objectives we are trying to accomplish, we believe that a nonexclusive geographic area licensing approach, described below, has the benefits of site-based licensing and the efficiencies and administrative benefits associated with geographic area licensing. Accordingly, we are adopting non-exclusive geographic area licenses. To address the concerns raised in support of frequency coordination and site-by-site licensing, we also adopt a post-license registration requirement.

57. *Non-exclusive geographic area licensing.* Non-exclusive area licensing is flexible, especially in light of the technical characteristics of DSRCS, *i.e.*, low power and short range. Moreover, geographic area licensing can accommodate many different licensees offering different DSRC-based ITS applications, which we believe will promote the use of the 5.9 GHz band and the development of new and innovative DSRC services. Moreover, geographic area licensing is preferable to site-based licensing, in this instance, because geographic area licensing involves significantly less expense than site based licensing. Thus, given the low power of RSUs, the interference-mitigation provisions of the ASTM-DSRC Standard, and that the potential number of sites could be in the tens of thousands, we conclude that the burden and expense that site licensing (even if we authorized several sites per license) would impose on applicants and the Commission is unwarranted. Similarly, we find that mandatory frequency coordination will not be necessary because the ASTM-DSRC Standard will promote the sharing between DSRC operations in this band such that imposing the cost and delay of mandatory frequency coordination is unwarranted. Moreover, we are concerned that licensing RSUs for less than all of the service channels would impede DSRCS flexibility in using the band with the other co-primary allocations.[195] Accordingly, we adopt non-exclusive geographic-area licensing for DSRC operations in the 5.9 GHz band.[196]

[189] ITS America Comments at 15.

[190] *Id.* at 15-16.

[191] ITS America Reply Comments at 12.

[192] Mark IV Industries Comments at 9.

[193] *See* National Assoc. of Telecommunications Officers and Advisors/National League of Cities Comments at 3. *See also* National Emergency Number Association at 3.

[194] Intersil Corporation Reply Comments at 4 n.10.

[195] In allocating the 5.9 GHz band for DSRC operations, the Commission noted, in part, that seventy-five megahertz of spectrum "will provide the flexibility needed to share the spectrum with incumbent operations." *Allocation Report and Order*, 14 FCC Rcd at 18225 ¶ 9. *See also*, ET Docket No. 98-95, DOT Reply Comments at 3 (DOT cited an ARINC study that "in order to avoid potential interference from incumbent users in the 5.9 GHz band, an allocation of 75 MHz" was necessary "as a practical matter.").

[196] Because licenses will be non-exclusive, there will be no mutual exclusivity between or among applications. Consequently, our competitive bidding authority is not implicated. *See BBA Report and Order*, 15 FCC Rcd at (continued....)

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[196] Because licenses will be non-exclusive, there will be no mutual exclusivity between or among applications. Consequently, our competitive bidding authority is not implicated. *See BBA Report and Order*, 15 FCC Rcd at (continued….)

58. With regard to governmental entities, we believe that a geographic-area licensing plan based on that entity's legal jurisdictional area of operations is most appropriate. With regard to non-governmental entities, we believe that they can be licensed based on each applicant's area-of-operation, *i.e.*, by county, state, multi-state, or nationwide. We will determine applicant qualifications for these non-exclusive geographic-area licenses in accordance with FCC Form 601 and our Rules. Those applicants who are approved will each be granted a non-exclusive license for the geographic-area requested, *i.e.*, county, state *etc.*[197] There is no limit to the number of non-exclusive geographic-area licenses that may be granted for this band. Because such licenses serve as a prerequisite of registering individual RSUs located within the licensed geographic area, each licensee will be authorized for seventy-megahertz of co-primary spectrum, 5.855-5.925 GHz. Authorizing licensees for all of the 5.9 GHz band, except for the reserve,[198] and adopting the ASTM-DSRC Standard, which channelizes the spectrum, are complementary. This spectrum will not be subject to any aggregation limit, so each licensee will use channels in accordance with the ASTM-DSRC Standard.

59. *Post license registration requirement.* As noted, we believe that most of the concerns raised in support of site-by-site licensing can be addressed through a post-license registration process somewhat similar to the one we adopted in our *70-80-90 GHz Report and Order.*[199] We believe that the registration process must be streamlined, particularly in light of the potential for thousands of coordinated RSUs in this band. Licensees will register RSU sites, channels, and other relevant data on the Universal Licensing System (ULS) under the call sign of the relevant license.[200] Nonetheless, we observe that there may be administrative benefits to having RSU registrations maintained in a third-party (*i.e.*, non-FCC) database. Given that the DSRCS is evolving, we will continue to collaborate with DOT in considering whether it would be prudent to have RSU registrations housed on a system other than ULS.[201] Given that the post license registration process will also implement the requirement to coordinate certain DSRC stations through NTIA, *see* paragraph 73, *infra*, we will consult with NTIA prior to any change in the registration process we adopt today.

60. Licensees must register each RSU in the Universal Licensing System (ULS) and authority to operate a given RSU begins after the Wireless Telecommunications Bureau (Bureau) screens the filing and posts the registration on the ULS. The Bureau will use an automated "overnight batch" program to screen registration filings and RSUs that do not require additional processing will be posted within one business day (for electronically filed registrations). RSU registrations are subject, *inter alia*, to the requirements of Section 1.923 of the Commission's rules (antenna structure registration,[202]

(Continued from previous page)

22,715 ¶ 14. Given that we are not authorizing licenses via competitive bidding, we have no need to address in this *Report and Order* the various competitive bidding-related issues that were raised in the *NPRM*, which included matters of competitive bidding design, designated entities, bidding credits, application and payment procedures, reporting requirements, collusion issues, and unjust enrichment. *See NPRM*, 17 FCC Rcd 23,179-81 ¶¶ 75-81.

[197] 47 C.F.R. §§ 1.913-1.917. FCC Form 601 – *Application for Authorization in the Wireless Radio Service.*

[198] At this time, we are not adopting licensing and service rules for the five megahertz reserve located in the 5.850-5.855 portion of the 5.9 GHz band.

[199] *See* Allocations and Service Rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands, WT Docket No. 02-146, *Report and Order*, 18 FCC Rcd 23318 (2003) (*70-80-90 GHz Report and Order*).

[200] This information is described with more specificity in Appendix F.

[201] By comparison, in the *70-80-90 GHz Report and Order*, we determined that non-Federal Government links will be registered in a third-party (*i.e.*, non-FCC) database after an interim period. *See 70-80-90 GHz Report and Order* at ¶ 50.

[202] *See* 47 C.F.R. § 1.923(d) citing 47 C.F.R. Part 17.

environmental concerns,[203] international coordination,[204] and quiet zones[205]). Additionally, RSUs at locations subject to NTIA coordination (see § 90.371(b) of this part) may not begin operation until NTIA approval is received. RSU registrations that raise these issues may require additional time to process. Accordingly, licensees must plan ahead given that authority to operate does not begin until the registration process is completed.[206]

61. *DSRCS Interference Disputes.* Given the low power of RSUs and the interference-mitigation provisions of the ASTM-DSRC Standard, interference disputes among DSRC operations should be rare. Nonetheless, we clarify that in the event a dispute arises, it is to be resolved using the priority framework set forth in paragraph 31, *supra*.[207] If a dispute arises between non-public safety RSU licensees, the licensee of the later-registered RSU must accommodate the operation of the early registered RSU, *i.e.*, interference protection rights would be date-sensitive, based on the date that the RSU is first registered and the later registered RSU would have to modify its operations.[208]

b. OBUs

62. With regard to OBUs, we noted in the *NPRM* that there could be two kinds of OBUs, those associated with an RSU and those not associated with an RSU.[209] In this context, we invited comment on whether the OBU associated with an RSU should be licensed under the associated RSU's license. With regard to OBUs not associated with an RSU, we requested comment on whether to license them by rule, or authorize their use as unlicensed under Part 15 of our Rules.[210]

63. As a preliminary matter, we note that there is contradictory information in the record concerning whether there are OBUs that are associated with an RSU. ITS America notes that "while there will be instances where a licensee will deploy a number of On-Board Units for communication with its Roadside Units, it is expected that the majority of On-Board Units will be deployed without any association with a particular licensee or fixed system."[211] Johns Hopkins, however, states that because "OBUs are general purpose devices, supporting a wide range of both private and public services throughout the nation, it is impossible to associate these OBUs with a single system."[212] From ITS America's statement in the First Proposed Band Plan, it appears that not all OBUs are general purpose

[203] *See* 47 C.F.R. § 1.1307.

[204] *See, e.g.* 47 C.F.R. § 1.928 (regarding frequency coordination arrangements between the United States and Canada).

[205] 47 C.F.R. § 1.924.

[206] *Accord 70-80-90 GHz Report and Order* at ¶ 56 (the Commission believes the licensee is in the best position to determine the nature of its operations and whether those operations impact certain settings).

[207] We clarify that this prioritization only applies between DSRC operations and does not affect interference rights relative to the other services operating in this spectrum.

[208] Because registration filing dates may be time-sensitive and given the minimal burden involved in filing a new registration for an RSU that needs to change locations or channels, we will limit the capability to modify site registrations.

[209] *NPRM*, 17 FCC Rcd at 23167 ¶¶ 52-53.

[210] 47 C.F.R. Part 15.

[211] ITS America Comments at 19.

[212] Johns Hopkins Comments at 12.

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OBUs; some OBUs are used for public safety purposes only. For instance, ITS America indicated that public safety vehicles would have two OBUs, with the second OBU, which does not use the Control Channel, used for intersection applications, such as "Emergency Vehicle Signal Pre-emption."[213] It appears, from this description, that this second OBU would be associated with a fixed system. We note that several commenters, especially toll agencies, support licensing OBUs under the associated RSU license.[214]

64. Regardless of this inconsistency in the record, the majority of commenters favor licensing all OBUs by rule. Specifically, these commenters note that licensing by rule is consistent with the technical characteristics of OBUs.[215] A licensing by rule regime would require OBUs to comply with transmission power limits, and specific rules on timing intervals and length of transmission, especially concerning the Control Channel, as found in the ASTM-DSRC Standard.[216] Other commenters note that licensing OBUs by rule balances the operational characteristics of the OBUs with providing the license status necessary for full operation.[217] Commenters also claim that licensing OBUs by rule would enhance the development of new devices as well as speed production and market growth.[218]

65. Most commenters oppose unlicensed operations under Part 15 for any DSRC-based ITS application, whether associated or not associated with a fixed system. These commenters maintain that Part 15 does not provide the needed technical protection necessary for DSRC operations.[219] NTIA agrees with these commenters and states that Part 15 would not offer sufficient protection for public safety and safety-related services, which could prohibit the deployment of critical public safety DSRC applications, thus potentially reducing the overall public benefits envisioned for DSRC.[220] Nissan argues that DSRC operations under Part 15 are "likely to cause interference with safety applications in terms of reduced channel availability and capacity, especially regarding the control channel, as well as increased latency."[221] The Alliance of Automobile Manufacturers argues against unlicensed operations, stating that radio frequency interference from unlicensed devices and their noncompliance with channel controls and the message prioritization framework would undermine the projected effectiveness of vehicle safety enhancements made possible by DSRC; therefore, unlicensed devices may have the ability to cause these same safety applications to fail during emergencies, putting lives and property unnecessarily at risk.[222]

66. In supporting unlicensed operations under Part 15, Intersil Corporation maintains that those opposed to unlicensed operation of OBUs underestimate the technical control available under

[213] First Proposed band Plan at 7.

[214] *See* IBTTA Comments at 7; North Texas Tollway Authority Comments at 2; Maine Turnpike Authority Comments at 2; Delaware Department of Transportation Comments at 2; Siemens Transportation System Comments at 6.

[215] ITS America Reply Comments at 15.

[216] *Id.* at 16.

[217] E-ZPass Reply Comments at 6.

[218] E-ZPass Comments at 12.

[219] ITS America Reply Comments at 16.

[220] NTIA Comments at ii.

[221] Nissan Comments at 7.

[222] Alliance of Automobile Manufacturers Reply Comments at 2.

Part 15: Intersil notes that some Part 15 devices are subject to extremely detailed technical rules and there is "extensive precedent for controlling any needed transmitter characteristics under Part 15."[223] Again, we note that DOT did not comment on licensing issues, instead asking that whatever option we choose should support interoperability and uniform technical standards.[224]

67. We note that authorizing unlicensed operations is an efficient means to promote a variety of operations, under certain technical requirements to ensure that they do not cause interference, even if an allocation does not exist for those operations. In this case, ITS DSRC applications have a primary allocation in the Mobile Service and our "license by rule" mechanism is an appropriate method to allow widespread deployment of OBUs without unnecessarily burdensome individual licensing requirements. We believe this approach is consistent with the ASTM-DSRC Standard and is particularly appropriate here because the 5.9 GHz band will be shared among millions of motorists, and thus, there will be no mutual exclusivity between users. In addition, "licensing by rule" will minimize regulatory procedures and thus facilitate deployment while protecting public safety communications. Further, we do not think the "license-by-rule" approach will threaten the protection of public safety operations because such protections are addressed through the operating standards adopted herein, rather than through an individual licensing mechanism.

2. Government Radar Operations-to-DSRC

68. *Background.* In 1999 the Commission allocated the 5.9 GHz band to the DSRCS.[225] Because this seventy-five megahertz of spectrum is co-allocated on a co-primary basis for both Federal Government and non-Federal Government use, coordination between non-Federal Government (private entities and state and local governments) and Federal Government operations is of critical interest. Accordingly, in the *Allocation Report and Order*, the Commission adopted Section 90.371(b), which provides that "DSRCS stations operating in the 5.9 GHz band shall not receive protection from Government radar services in operation prior to the establishment of the DSRCS station."[226] The rule further requires that operation of DSRCS stations within seventy-five kilometers of fifty-nine locations (current or future Government radar sites that DoD reported to the Interdepartment Radio Advisory Committee (IRAC) in 1997) must be coordinated through NTIA.[227] In the *NPRM*, we noted that new Government radar installations that may be deployed subsequent to DSRC implementation must coordinate with incumbent DSRC operations.[228] In this connection, we requested comment on whether we should adopt specific provisions to forestall interference from new high power government radar operations to the DSRC Control Channel.

69. *Discussion.* The Federal Government is the largest incumbent user of the 5.9 GHz band.[229] According to NTIA, the Department of Defense (DOD) uses fixed, transportable, and mobile

[223] Intersil Corporation Reply Comments at 4-5.

[224] DOT Comments at 8.

[225] *Allocation Report and Order,* 14 FCC Rcd at 18225 ¶ 9. The DSRCS also shares the band on a co-primary basis with Fixed Satellite Service uplinks.

[226] 47 C.F.R. § 90.371(b).

[227] *Id. See also* NTIA Comments at 14.

[228] *NPRM,* 17 FCC Rcd at 23171 ¶ 58 citing *Allocation Report and Order,* 14 FCC Rcd at 18228 ¶ 14.

[229] NTIA Comments at 3.

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[229] NTIA Comments at 3.

radars for surveillance, test range instrumentation, airborne transponders, and experimental testing.[230] DOD uses these radars extensively in support of national and military test range operations in the tracking and control of manned and unmanned airborne vehicles.[231] The NTIA reports that "[t]he potential interference between these incumbent military systems and DSRC stations was addressed to the satisfaction of the DoD . . . and resulted in the coordination zones"[232] found in Section 90.371(b) of our Rules. NTIA states that Section 90.371(b) strikes "a reasonable balance between establishing new services that will benefit the public and allow[ing] for the continued operation of Government radar systems to support national defense."[233] In this connection, the Commission adopted the coordination zones in Section 90.371(b) as a result of studies sponsored by DOT and performed by NTIA's Institute for Telecommunication Sciences in 1997.[234] At the time of the testing, DoD provided IRAC with a list of all existing and planned locations for Government radar in the 5.9 GHz band that would require coordination.[235] Because an American standard had not yet been developed, at the time of the testing, the Institute used the European and Japanese standard to perform all the testing and analysis.[236] DOT states that this analysis considered worst-case scenarios to ensure the degree of protection and flexibility described by DoD, but it did not examine mitigation techniques to reduce the coordination zones.[237] The electromagnetic compatibility (EMC) tests and analysis were the basis for developing the coordination zones established in Section 90.371(b).[238]

70. Given these changes since the 1997 study, DOT plans to conduct another study using the details of the ASTM-DSRC Standard that have been finalized to determine the effectiveness of the current coordination zones listed in Section 90.371(b) of our Rules.[239] DOT reports that the new study, to be performed by DOT in cooperation with DoD, will examine the effectiveness that mitigation

[230] *Id.* at 11.

[231] *Id.*

[232] NTIA Comments at 11-12.

[233] *Id.* at 4.

[234] *Id.* at 13. *See also* Institute for Telecommunications Sciences, National Telecommunications and Information Administration (NTIA), *Electromagnetic Compatibility Testing of a Dedicated Short-Range Communication System*, Report 98-352 (1998).

[235] NTIA Comments at 14.

[236] *Id.* at 13. These studies included electromagnetic compatibility (EMC) tests of DSRC equipment and . . . analysis of interference to DSRC receivers. To examine potential interference, the EMC testing used simulated radar signals that were coupled into the DSRC receiver considering both co-channel and off-channel radar operations. The radar signals were selected to represent the range of parameters used by both existing radars and possible future radar designs. As a result of the EMC testing, it was determined that improved DSRC system performance in the presence of interfering radar signals may be achieved through the use of shorter DSRC data packets and possibly through the use of forward error correction (FEC) into the DSRC coding scheme. Based on the EMC tests, an analysis was performed that considered other factors such as antenna coupling and separation distances, which could provide additional protection to DSRC receivers. *Id.*

[237] DOT Comments at 9.

[238] NTIA Comments at 13.

[239] NTIA Comments at 15. As noted below, we will examine the results of the study before amending the coordination zones.

techniques, such as terrain shielding, directional antennas, and RF fencing could have on a case-by-case basis, as well as future radar pulse waves.[240]

71. According to NTIA, DoD has expressed the concern that, in light of the terrorist attacks of September 11, 2001, Government radars may be used to support homeland defense.[241] Because of the limited amount of spectrum available for future radar development, it is likely that these new radar systems will be developed for use in the 5.9 GHz band.[242] Moreover, NTIA relates that this expanded role of government radar may result in deployment of radars in areas other than the fifty-nine sites listed in Section 90.371(b) of our Rules.[243] NTIA notes that some of these sites could include cities and highways where DSRC equipment is expected to be used.[244] NTIA further relates that DoD is concerned that this expanded deployment of 5.9 GHz radars could increase the potential for interference with DSRC operations.[245]

72. NTIA recommends that the Commission wait until the conclusion of the new testing before adopting any additional provisions to prevent interference from future Government radar operations.[246] We agree and will follow the recommendation. Additionally, given that DoD may deploy radars in areas other than the fifty-nine sites listed in Section 90.371(b), we delegate authority to the Wireless Telecommunications Bureau to update this list.[247]

73. We will use the post-license registration process to implement the NTIA coordination requirement of Section 90.371(b). Specifically, ULS will be programmed to refer RSU registrations through NTIA that are within seventy-five kilometers of any of the existing Government radar sites listed in Section 90.371(b). In this connection, ULS will notify the licensee that the site is not registered pending NTIA coordination, which will be accomplished under the existing coordination process, *i.e.*, coordination with NTIA through IRAC.[248] While this process remains in effect, NTIA has informed us, it will, through the IRAC's Frequency Assignment Subcommittee, coordinate requests within fourteen working days of receipt.[249]

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240 DOT Comments at 9; NTIA Comments at 15.

241 NTIA Comments at 14.

242 *Id.*

243 *Id.*

244 *Id.*

245 *Id.*

246 *Id.* at 15.

247 Once a Federal Government assignment is made it will be protected and the staff will update the ULS database, accordingly.

248 We note that the filing date of the proposed RSU registration will serve as the licensee's date stamp relative to any "first-in-time" issues.

249 NTIA has further indicated that it will provide a website indicating the applications that it has received from the Commission, the date received, the date action is complete, and the status. NTIA will provide the location of that site via a public notice.

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3. Fixed Satellite Service Uplinks-to-DSRC

74. *Background.* The 5.9 GHz band, is known in the satellite industry as the "extended C-band" and is used to provide uplinks for intercontinental FSS services and is adjacent to the more heavily used "C-band" FSS uplink spectrum at 5.925-6.425 GHz."[250] According to the Satellite Industry Association (SIA), the "extended C-band" and the "C-band" are among the principle frequency bands for the global FSS industry.[251] We note that the C-band is extensively used by the Fixed Service for point-to-point microwave, although we did not receive comment from any Fixed Service provider regarding DSRC operations.

75. NTIA's Institute for Telecommunications Services also studied the potential for interference from FSS uplink operations into DSRC operations in the 5.9 GHz band.[252] The Institute for Telecommunications Services found that there is a limited scope of potential co-channel interference to DSRC operations from FSS earth stations because they use highly directional antennas and the number of FSS earth stations is limited. The DOT concluded that there was a minor, but irreducible need for coordination between FSS earth stations and DSRC operations if they are within 2 miles of each other.[253]

76. The Commission did not adopt a coordination requirement between DSRC and FSS operations in the *Allocation Report and Order*, stating that it would most likely be unnecessary, but also stating that it would consider the matter in a future proceeding.[254] PanAmSat petitioned for reconsideration of this issue and suggested that without coordination procedures, widespread DSRC deployment could give rise to extensive areas where future FSS earth station would be excluded. PanAmSat also suggests that the level of DSRC deployment should account for the "noise floor" that is present from FSS uplinks.[255] We dismissed the Petition for Reconsideration in the *NPRM* as moot because the issues raised by PanAmSat would be addressed in this proceeding.[256] We then sought comment on whether prior coordination between DSRC operations and FSS uplinks is necessary.[257] The Commission further sought comment on whether, in light of incumbent and potential future FSS operations, the ASTM-DSRC Standard would provide robust and reliable DSRC operations.[258] We further asked whether DSRC equipment and operations should take into account the "noise floor" that is present from FSS uplink transmissions.[259] We were particularly interested in whether FSS uplink

[250] Satellite Industry Association Reply Comments at 2-3.

[251] *Id.* at 3.

[252] DOT Comments at 8. *See also* Institute for Telecommunication Sciences, NTIA, *Measured Occupancy of 5850-5925 MHz and Adjacent 5-GHz Spectrum in the United States* (1999) (FSS Study).

[253] FSS Study at ix.

[254] *Allocation Report and Order,* 14 FCC Rcd at 18228 ¶ 15.

[255] PanAmSat Corporation, Petition for Reconsideration or Clarification at 2 (filed Dec. 27, 1999).

[256] *NPRM*, 17 FCC Rcd at 23139 ¶ 3.

[257] *Id.* at 23170 ¶ 57.

[258] *Id.*

[259] *Id.*

transmissions in the 5.9 GHz band would interfere with the DSRC Control Channel.[260] The commenters identify two interrelated issues: "noise floor" and "prior coordination. We will next address these issues.

77. *Discussion*. Regarding the first issue, PanAmSat and SIA maintain that we should establish a "noise floor" to ensure that DSRC equipment can withstand out-of-band emissions from FSS earth stations operating in the adjacent conventional C-band at 5.925-6.425 GHz.[261] In fact, SIA states that, through the Commission's FSS earth station operational rules[262] combined with minimum permissible earth station elevation angle, the Commission has established such a noise floor with respect to out-of-band emissions from conventional C-band earth stations.[263] ITS America emphasizes that in developing the ASTM-DSRC Standard, the Standards Writing Group considered and took steps to mitigate the potential from in-band and out-of-band emissions from the C-band satellite operations.[264] For instance, ITS America notes that the Standards Writing Group located the Control Channel in the middle of the band.[265] ITS America further notes that Channel 184, which will be used for high-powered DSRC operations (1000 meters or less) most frequently in cities, is located at the lower end of the C-band at 5915-5925 MHz, which should not result in interference because the existing satellite uplinks are located in areas away from population centers.[266] Moreover, ITS America asserts that out-of-band emissions from these FSS earth stations will likely be no greater than out-of-band emissions from the higher power operations in Channel 184.[267] We did not receive any comment from Fixed Service point-to-point microwave providers on this issue.

78. Regarding the second issue, "prior coordination," SIA contends that prior coordination is necessary between new DSRC operations and existing earth station teleports and new earth station teleports and existing DSRC operations.[268] Both ITS America and DOT contend that DOT's FSS Study showed that the potential for interference between FSS uplinks and DSRC operations is minimal because the FSS uplinks in the C band use a very narrow emission footprint on the ground, and that interference can be avoided through the use of a frequency coordinator and the use of mitigation techniques, such as terrain shielding, directional antennas, and radio frequency fencing.[269] ITS America contends that licensees can locate RSUs outside any potential satellite uplink interference area.[270] SIA further recommends that we establish protection and coordination provisions modeled after Section 90.371(b) for

[260] *Id.*

[261] PanAmSat Comments at 1; Satellite Industry Association Reply Comments at 5.

[262] The FSS earth station operational rules are 47 C.F.R. §§ 25.202(f), 25.209, 25.211, 25.212.

[263] SIA Reply Comments a 7.

[264] ITS America Reply Comments at 19.

[265] *Id.*

[266] *Id.*

[267] *Id.*

[268] Satellite Industry Association Reply Comments at 8-9.

[269] ITS America Reply Comments at 19-20; DOT Comments at 9.

[270] ITS America Reply Comments at 19.

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FSS earth stations and DSRC stations.[271] Under such a provision, prior coordination would be necessary only in identified geographic regions.

79. In November 2003, ITS America and SIA reported that they are discussing the development of a sharing protocol between DSRC and FSS operations in the 5.9 GHz band.[272] The parties state that significant progress has been made in these discussions and they are hopeful that an agreement will be reached. In this connection, SIA avers that given the complexity of these issues and that industry discussions remain ongoing, the Commission should defer any decision on DSRC-FSS sharing until after the ongoing technical studies and industry discussions have been completed, and the parties have had an opportunity to present their conclusions.

80. We commend the efforts of ITS America and members of the satellite industry to resolve these issues. Because the record does not contain an analysis of the ASTM-DSRC Standard relative to FSS uplinks, and given the ongoing industry study and discussions, we agree that a decision on these issues would be premature. Accordingly, based on the record before us, we will not adopt rule changes at this juncture but will reserve the right to revisit this issue if necessary once the results of the industry study and discussions are known. Given the importance of safety/public safety applications in the DSRC, we urge the parties to conclude the technical study as quickly as possible to ensure that the ASTM-DSRC Standard will be able to provide robust and reliable DSRC operations near FSS uplink sites.[273]

E. General Application, Licensing, and Processing Rules

81. *Background.* In the *NPRM*, we proposed to apply the application, licensing, and processing rules set forth in Part 90, Subpart G and in Part 1, Subpart F of our Rules for public safety and for non-public safety licensees in the event that we selected a licensing framework that did not result in mutually exclusive applications.[274] We also sought comment on construction or coverage requirements, license terms, and renewal expectancy.[275]

82. *Discussion.* In light of the record of this proceeding and our decision to adopt a non-exclusive geographic area licensing scheme, we will apply the application, licensing, and processing rules set forth in Part 90, subpart G of the Commission's Rules[276] for both public safety and non-public safety applicants as we proposed. We believe that applying Part 90, Subpart G to both public safety and non-public safety applicants enables sharing of the band and is consistent with other services subject to Part 90. As discussed, *supra*, CMRS is not excluded from the definition of DSRC. Nonetheless, except for applications that specify interconnection with the public switched network, we adopt a presumption that DSRC is private mobile radio service (PMRS). Therefore, only applicants that elect interconnected common carrier status will be required to provide the information that CMRS applicants must submit in order to address the alien ownership restrictions under Section 310(b) of the Act.[277]

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[271] Satellite Industry Association Reply Comments at 9.

[272] *See* Letter from Robert B. Kelly, Esq., counsel to ITS America, to Marlene H. Dortch, FCC (Nov. 14, 2003); Letter from Richard DalBello, President, SIA to Marlene H. Dortch, FCC (Nov. 19, 2003).

[273] We also observe that the post-license registration process that we are adopting may facilitate spectrum sharing.

[274] *NPRM*, 17 FCC Rcd at 23173 ¶ 63.

[275] *Id.* at 23173 ¶ 64.

[276] 47 C.F.R. Part 90, subpart G.

[277] *See* 47 C.F.R. § 20.5 (Citizenship).

83. *Construction requirements.* ITS America recommends that we require both public safety and non-public safety RSUs to be placed in operation within twelve months from the date of license grant or the authorization cancels immediately.[278] We believe that the overarching purpose of our requirements in this setting, concerning construction, modification,[279] and discontinuance of RSUs is to maintain the integrity of the information in the relevant databases by correctly reflecting the actual record concerning these issues.[280] Therefore, we will adopt the 12-month construction requirement found in Section 90.155 of our Rules[281] and clarify that in this setting, each construction period will commence on the date that the Wireless Telecommunications Bureau posts an RSU registration on the database. However, we will not require licensees to file notifications of compliance for each RSU as is ordinarily required by Section 1.946(d) of the Commission's Rules. We will instead rely on licensees to withdraw unconstructed or discontinued RSUs from the registration database. We reserve the discretion to revisit this issue if our experience with DSRCS indicates that additional measures are necessary.

F. Canadian and Mexican Coordination

84. *Background.* In the *NPRM,* we noted that we do not have international agreements between, and among the United States, Mexico, and Canada concerning the 5.9 GHz band spectrum for ITS applications.[282] We further noted that although the agreement with the Canadian Government, "Agreement Concerning the Coordination and Use of Radio Frequencies Above Thirty Megacycles per Second," with Annex, as amended, applies to the 5.850-5.925 GHz band, no agreement is in place for the current ITS allocation.[283] As a consequence, we stated that licensees may be subject to future agreements with Canada and Mexico and therefore may be subject to further modification. We requested comment on whether to adopt certain interim requirements for terrestrial licenses along these borders, and to provide that licensees will be subject to the provisions contained within future agreements between and among the three countries. Until such time as agreements with Mexico and Canada become effective, we proposed to apply the same technical restrictions at the border that we adopt for operation between service areas, *i.e.* operations must not cause harmful interference across the borders.[284] Commenters on this issue noted the importance of spectrum harmonization across the borders.

85. *Discussion.* The record before us reflects that DSRCS operations in the 5.9 GHz band may be subject to future agreements with Canada and Mexico. As such, we could either prohibit DSRCS operations in border areas pending agreements or authorize DSRCS operations in border areas subject to modifications or future agreements. We conclude that the latter approach is appropriate because DSRCS operates at relatively low power levels that are unlikely to cause harmful interference to operations in

[278] July *Ex Parte* Comments at 66.

[279] *See* note 208 *supra*, concerning "modifications" to RSU registrations.

[280] In this setting, if the construction requirement is not met, although the licensee will not be barred from re-registering and constructing the RSU later, it will lose the original registration date for the purpose of resolving time-sensitive disputes between non-public safety RSU licensees. See para. 61, *supra*.

[281] 47 C.F.R. § 90.155.

[282] *NPRM*, 17 FCC Rcd at 23178 ¶ 74.

[283] *NPRM*, 17 FCC Rcd at 23178-79 ¶ 74 *citing* Exchange of Notes at Ottawa, Canada, October 24, 1962. Entered into force October 24, 1962. *See* USA: *Treaties and Other International Acts Series* (TIAS) 5205; CAN: *Canada Treaty Series* (CTS) 1962 No. 15. *Agreement for Revision to Technical Annex to the Agreement of October 24, 1962* (TIAS 5205/CTS 1962 No. 15) Effected by Exchange of Notes at Ottawa, Canada, June 16 and 24, 1965. Entered into force June 24, 1965. USA: TIAS 5833/CAN: CTS 1962 No. 15, as amended June 24, 1965.

[284] *NPRM*, 17 FCC Rcd at 23179 ¶ 74.

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Canada or Mexico. Moreover, the record before us reflects that Canada[285] has allocated the 5.9 GHz band for DSRC use and that Mexico[286] may allocate the 5.9 GHz band for DSRC use. Accordingly, we are adopting a rule that DSRCS operations in border areas (1) must not cause harmful interference to stations in Canada or Mexico (that are licensed in accordance with the international table of frequency allocations for Region 2, *see* 47 C.F.R. § 2.106) and (2) are issued conditionally, subject to modifications or future agreements with Canada or Mexico.

V. PROCEDURAL MATTERS

A. Final Regulatory Flexibility Analysis

86. This *Report and Order* includes a Final Regulatory Flexibility Analysis at Appendix B.

B. Paperwork Reduction Analysis

87. This *Report and Order* contains either a new or modified information collection. As part of the Commission's continuing effort to reduce paperwork burdens, we invite the general public and the Office of Management and Budget (OMB) to take this opportunity to comment on revision to the information collections contained in the *Report and Order* as required by the Paperwork Reduction Act of 1995.[287] Public and agency comments are due ***[60 days after date of publication in the Federal Register]***. Comments should address:

- Whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility.
- The accuracy of the Commission's burden estimates.
- Ways to enhance the quality, utility, and clarity of the information collected.
- Ways to minimize the burden of the collection of information on the respondents, including the use of automated collection techniques or other forms of information technology.

Written comments by the public on the new or modified information collections are due ***[60 days from date of publication in the Federal Register.]*** Written comments must be submitted by the public, Office of Management and Budget (OMB), and other interested parties on the new and/or modified information collections on or before ***[60 days from date of publication in the Federal Register.]*** In addition to filing comments with the Secretary, a copy of any Paperwork Reduction Act comments on the information collection(s) contained herein should be submitted to Judith B. Herman, Federal Communications Commission, Room 1-C804, 445 12th Street, SW, Washington, DC 20554, or via the Internet to Judith-B.Herman@fcc.gov and to Kim A. Johnson, OMB Desk Officer, Room 10236 NEOB, 725 17th Street, N.W., Washington, DC 20503 via the Internet to Kim_A._Johnson@omb.eop.gov or by fax to 202-395-5167.

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[285] *See* ASTM-DSRC Standard at 9-10 § 8.8.3.3 and Table 8. *See also NPRM*, 17 FCC Rcd at 23178-79, n.333 citing July *Ex Parte* Comments at 17. (ITS America reported that Industry Canada was in the process of allocating the 5.855-5.925 GHz band for DSRC applications and that "Spectrum Management, Radio Standard Specification, Location and Monitoring Service," a proposed nationwide Canadian standard, would likely be adopted and include the same channelization plan as specified in the ASTM-DSRC Standard.)

[286] *See e.g.*, note 103, *supra* and accompanying text.

[287] *See* Pub. L. No. 104-13.

C. Further Information

88. For further information concerning the *Report and Order,* contact Nancy M. Zaczek regarding legal maters, and/or Gerardo Mejia regarding engineering matters via phone at (202) 418-0680, via TTY (202) 1418-7233, via e-mail at Nancy.Zaczek@fcc.gov; Gerardo.Mejia@fcc.gov, respectively, or via regular mail at Federal Communications Commission, Wireless Telecommunications Bureau, 445 12th Street, SW, Washington, D.C. 20554.

89. Alternative formats (computer diskette, large print, audio cassette, and Braille) are available to persons with disabilities by contacting Brian Millin at (202) 418-7426, TTY (202) 418-7365, or via e-mail to bmillin@fcc.gov. This *Report and Order* can be downloaded at http://wireless.fcc.gov/releases.html#orders.

VI. ORDERING CLAUSES

90. ACCORDINGLY, IT IS ORDERED that, pursuant to Sections 1, 4(i), 302, 303(f) and (r), and 332 of the Communications Act of 1934, as amended, 47 U.S.C. 1, 154(i), 302, 303(f) and (r), and 332, this *Report and Order* is ADOPTED.

91. IT IS FURTHER ORDERED that Parts 0, 1, 2, 90, and 95 of the Commission's Rules ARE AMENDED as specified in Appendix A, effective sixty days after publication in the Federal Register. Information collection contained in these rules will be effective upon OMB approval.

92. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this REPORT AND ORDER, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the U.S. Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

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